DOCUMENT RESUME

ED 026 626 24 AL 001 622

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Bureau No-BR-5-0602
Pub Date [68]
Contract-OEC-1-6-050602-0431
Note-15p.
EDRS Price MF-$0.25 HC-$0.85
Descriptors-Age Differences, *Association (Psychological), Child Language, Distinctive Features, Psycholinguistics, *Recall (Psychological), Verbal Development, *Word Recognition

Forty third-graders and an equal number of sixth-graders listened to a list of words and for each word had to indicate, by saying "old" or "new," whether it had appeared before on the list or not. The subjects gave more erroneous "old" responses to words which were semantically or phonetically related to previously heard words than to control words. Furthermore, they took longer to respond correctly ("new") to the experimental words than to the controls. Experimental words which were highly associated to the preceding words did not produce more errors than words with little association to the preceding words. The semantic relations were relatively less effective in producing errors for the third-graders than for the sixth-graders. These findings are interpreted to favor the hypothesis advanced by Anisfeld and Knapp (ED 019 639) that false recognition results can be more adequately and directly explained by a logical analysis of the semantic and phonetic features common to words than by free association norms. The relatively lesser effectiveness of semantic relations in producing false recognition errors in the third-grade subjects than in the sixth-grade subjects suggests that at the younger age the semantic features for interrelating vocabulary items are not yet as prominent as the more superficial phonetic features. (Author/JD)

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ED026626

Semantic and Phonetic Relations in the False Recognition of Words by Third- and Sixth-Grade Children[1]

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Third-graders and sixth-graders listened to a list of words and for each word had to indicate, by saying "old" or "new," whether it had appeared before on the list or not. The Ss gave more erroneous "old" responses to words which were semantically or phonetically related to previously heard words than to control words. Furthermore, they took longer to respond correctly ("new") to the experimental words than to the controls. Experimental words which were highly associated to the preceding words did not produce more errors than words with little association to the preceding words. The semantic relations were relatively less effective in producing errors for the third-graders than for the sixth-graders. These findings are interpreted in a framework of a feature analysis of words.

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Given that children's vocabulary differs in extent from adult vocabulary, does it also differ in basic principles of underlying organization? The studies of Riess (1946) and Rice and Di Vesta (1965) bear on this question. In an experiment with girls at four age levels (8, 11, 14, and 18 year olds), Riess (1946) conditioned the GSR to five words (e.g., male) and measured extent of generalization (as compared to the preconditioning level) to homophones (mail), antonyms (female), and synonyms (man). He found that the youngest Ss generalized more to homophones than either to synonyms or to antonyms whereas with increasing age Ss generalized more to synonyms and antonyms than to homophones. There are two possible interpretations of these results. It could be that there was genuine generalization for all categories of word relations at all age levels and only the relative magnitude of generalization varied with age. Alternatively, it is possible that only the higher magnitudes reflect genuine generalization and the lower magnitudes merely reflect the effect of sensitization. This latter possibility arises because control words were not included to take account of possible sensitization (for a discussion of this methodological problem, see Feather, 1965). Besides the age factor in the effects of semantic and phonetic relations, Riess also reported a developmental shift within the semantic dimension. The two younger groups tended to generalize more to antonyms than to synonyms whereas the two older groups showed a reverse tendency. Rice and Di Vesta (1965) used a paired associate-learning procedure in studying developmentally the effects of phonetic and semantic relations. In their experiment, Ss first learned three word-nonsense syllable pairs to a criterion of five errorless trials. Following this they were given a homonym, a synonym and an antonym of each word and

asked to indicate which of the three nonsense syllables previously learned "belonged" with each of the words. The S was considered to show "generalization" if he gave the nonsense syllable previously learned to a particular word also to its homonym, synonym, and antonym. This was the first generalization phase. In the second phase, Ss were allowed three trials to actually memorize, in a paired-associate paradigm, the associations between the new words and the nonsense syllables. The more associations Ss formed in the three trials the higher their generalization score. For 12- and 20-year-old Ss, both the semantic and phonetic relations produced significant effects (as compared to control words) in both the first and second generalization phases, but the results for 9- and 11-year-old Ss were not consistent. The 11-year-olds showed a significant effect for all three categories in the second phase but only for homonyms in the first phase, and the 9-year-olds showed no effect for either of the three categories in the second phase and in the first phase showed an effect only for homonyms.

Although these studies suggest that with age there is an increase in the effects of semantic relations and a decrease in the effects of phonetic relations, the findings on this point are by no means conclusive. For instance, while Riess (1946) found that the oldest Ss tended to generalize more to semantically related words than to phonetically related words, Rice and Di Vesta (1965) found a tendency in the opposite direction (although not significant) for their oldest Ss.

Both methods employed rather circuitous procedures for assessing the effects of word relations. They both used the generalization of an acquired response--GSR in the first case and nonsense syllables in the second--as a measure of the prominence of different word relations across

ages. The present experiment used a more direct procedure in the investigation of these relations. Children at two age levels, third- and sixth-graders, listened to a list of words and they had to indicate for each word whether it had appeared before on the list or not. The number of false recognition errors, i.e., the S's saying that a word appeared before when it actually did not, made to words which are related semantically and phonetically to previously heard words will provide an indication of the prominence of the various relations. Response latency will be employed as another and perhaps more sensitive measure of the effects of word relations. Even when a S recognizes a word correctly as new, it may take him longer to do so for a word related to one previously heard than for an unrelated word.

Using the continuous recognition method with adults, Underwood (1965) found that Ss made significantly more errors to common associates (e.g., bread) of previously heard words (butter) than to control words not related to the preceding (P) words. He attributed the results to implicit elicitation of the associates during original presentation of the P words. Anisfeld and Knapp (1968) replicated the effect for associates but in addition they found that synonyms (e.g., dark) of P words (black) also produced false recognition effects, even though the synonyms were not associatively related to the P words. On the basis of their results, Anisfeld and Knapp suggested that words are not coded as absolute entities but in terms of their categorial or feature composition. Synonyms by definition share a certain semantic domain and hence are confused in memory. According to this view, the concept common associates is merely a cover term for a variety of semantic relations. Many common associates are antonyms (e.g., man-woman), some are synonyms (e.g., chill-cold), and few are fortuitous;

virtually all common associates have a meaningful relation to their stimuli. Anisfeld and Knapp have argued that it is this relation, rather than the association per se, that is responsible for the false recognition effect. The present experiment was designed to facilitate a comparison between the associative hypothesis of Underwood with the feature hypothesis of Anisfeld and Knapp. In this experiment as in the previous experiments, semantic relations were represented by synonyms and antonyms, but the phonetic dimension was represented by rhyming relations, because the auditory medium to be used here excludes homonyms. Half of the words in the semantic categories were common associates of the P words and half were not associated with the P words. If Underwood's hypothesis is correct, false recognition should be obtained for the associates but not for the non-associates. According to Anisfeld and Knapp, however, false recognition should be equally present in both halves, since the non-associates embody the same relations to the P words as the associates.

Method

Subjects

The sample was comprised of 40 third-graders (mean age = 8 yrs, 6 mo, range: 8 yrs to 9 yrs, 10 mo) and 40 sixth-graders (mean age = 11 yrs, 5 mo, range: 10 yrs, 11 mo to 12 yrs, 3 mo). There was an equal number of boys and girls at each grade level.

Materials and Procedure

In assembling words for the experiment, 24 word clusters were prepared. Each cluster consisted of five words: a P (preceding) word, an E (experimental) word related semantically (as a synonym or antonym) to the

P word, and a word which rhymed with the P word, a C (control) word for the Semantic E word, and a C word for the Rhyming E word. The C words had no relationship to the P words and were matched with their E counterparts on part of speech, syllabic length, and frequency of usage based on the Thorndike-Lorge (1944) Juvenile count and in a few cases on the Rinsland (1947) count. The 24 clusters may be seen in Table 1.

Insert Table 1 about here

The 24 semantic E words were equally divided among the following four categories: (a) three were synonyms of the P words and not commonly associated to them, (b) three were synonyms and common associates of the P words, (c) three were low-association antonyms, and (d) three were high-association antonyms. The association values for 23 clusters were obtained from the fourth-grade norms of Palermo and Jenkins (1964) and for one cluster from the third-grade norms of Entwisle (1966). In these norms, the average association value for categories (b) and (d) is 46% and the range is 21-88%. For categories (a) and (c) the average association value is 7% and the range 3-12%.

The 24 clusters were randomly divided in half to form two lists, A and B. Some clusters were then reshuffled to eliminate obvious relations among words other than those built in for experimental purposes.

The 60 words in each list were arranged in the following way. Each P word appeared twice on the list, the second token following the first by eight positions. Each E word was presented only once as was its corresponding C word. One position separated the C word from its E counterpart. The C words followed the E words in four cases and preceded them in eight

cases. The Semantic E word and the Rhyming E word always followed the second token of the appropriate P word. One of the E words was positioned 9 spaces after the P word and the other 14 spaces. An equal number of Semantic E words and of Rhyming E words was placed in the two positions. In addition, two orders were constructed for each list to counterbalance the order of the two E words within each cluster. The four categories of Semantic E words were evenly distributed throughout the list, one member of each category appearing in each third of the list.

The 12 clusters, including the repetitions of the P words, thus occupied 72 positions. The total list contained 121 items, with 49 positions being occupied by filler words, which had no obvious relation to any word in the list. Lists A and B contained the same filler words. Ten filler words appeared once each, 15 appeared twice each, and three appeared three times each. The first five positions in the list were occupied by fillers and there were 10 fillers in positions 6-20. The remaining 34 fillers were scattered throughout the list to make possible the ordering arrangements described above.

The entire list of 121 words was recorded on magnetic tape at the rate of one word every $5\frac{1}{2}$ sec. One second before each word there was an alerting signal to insure that S attended to the forthcoming word. The Ss were instructed to say "new" to words they heard the first time on the list and "old" to words they already heard before. They were given a pretest practice trial to make sure that the instructions were understood. The Ss were tested individually and the session was recorded.

All words in both list A and list B occur in the Watters and Curtis (1948) vocabulary list for second-graders. As another check on word

knowledge and to find out whether Ss perceived the words correctly, additional 12 3rd graders and 12 6th graders were presented with the tapes. Half of the Ss in each group listened to list A and half to list B. The 3rd graders had to repeat each word and to use it in a sentence or to define it. The 6th graders merely wrote down the words they heard. The results of this test show that the 3rd graders were able to use all words except brief (a Rhyming E word) which was unknown to five of the six Ss. This word, however, did not produce any atypical false recognition results. Most of the words were correctly perceived by the Ss; only three words were "misperceived" by 3-5 out of the 12 Ss who listened to each list.

Results

Two types of errors were possible in the experiment: (a) responding "new" to the second occurrence of P words and filler words, and (b) responding "old" to all other words. The interest of the present study was in the "old" responses, i.e., the false recognition errors, to the E and C words. The number of errors of any kind was minimal, amounting only to 9% for the 3rd graders and 8% for the 6th graders.

In addition to false recognition errors, the latency of responding "new" to E words and C words was also analyzed. For this analysis, the recorded tapes of each session were played through a rectifier into a Brush recorder where the auditory signal raised a continuously moving pen. By measuring the straight line between the onset of the stimulus word and the onset of Ss response it was possible to determine the response latency to each stimulus word. Latencies were recorded in millimeters where 25 mm = 1 sec.

As can be seen in Table 2, the E words did generally produce a higher

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Insert Table 2 about here

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error rate than the C words. Another and more subtle reflection of the effect of the relation of the E words to the P words is a significantly higher reaction time to the E words correctly identified as new than to the C words so identified. The mean of the Ss' reaction times to the Semantic E words and to Rhyming E words was 1.69 sec as compared with 1.60 sec and 1.56 sec to the respective C words. A comparison among the four categories of words reveals a significant effect, $F(3, 192) = 17.99$, $p < .001$. A Scheffe analysis shows that a difference of .089 sec is needed for individual comparisons to be significant at the 001 level. Thus, each of the E categories had significantly longer latencies than its corresponding C category. To check whether the E words might not perhaps have been longer than the C words, the mean duration of the E and C words was measured. These measurements show a virtually identical average duration for the E and C words; the mean duration for the E words was .64 sec as compared with .63 sec for the C words. The longer response latency to the E words is thus clearly due to their relation to the P words.

There was no difference between the grades in the overall magnitudes of the error effect and of the latency effect, but differences were found between the two grades in the relative effects of the Semantic and of the Rhyming relations. As can be seen in Table 2, for grade 6 both Rhyming and Semantic relations produced significant false recognition effects, while for grade 3 the Rhyming factor was significant but the Semantic factor generally was not. It may be calculated from Table 2 that the difference

between the mean number of errors to the E words and the mean number of errors to the respective C words is in the case of the 3rd grade higher for the Rhyming category (1.16) than for the Semantic category (.62) while for the 6th grade the respective magnitudes are reversed: Rhyming category = .92, Semantic category = 1.48. The category (Rhyming vs. Semantic)-by-Grade interaction is indeed significant, $F(1, 64) = 5.35$, $p < .025$.

The association factor did not play a significant role in the results. Summation of the four high-association E-minus-C scores in Table 2 yields a value of 1.04 and summation of the four low-association scores a value of 1.06. Similarly, there was no difference between the effect of the synonyms and of the antonyms: the E-minus-C sum for the four synonym scores in Table 2 being 1.03 and for the four antonym scores 1.07. Also, neither the association factor nor the synonymity-antonymy factor showed a significant interaction with age.

Discussion

The findings of higher error scores and reaction times to the E words than to the C words indicate that the relations among words inherent in the lexicon can influence the coding of individual words not only by adults--as was revealed in the experiments of Anisfeld and Knapp (1968) and Underwood (1965)--but also by children. The word relations that exerted an influence in this experiment were semantic and phonetic, associative relations did not play a significant role. This study thus favors the hypothesis advanced by Anisfeld and Knapp (1968) that false recognition results can be more adequately and directly explained by a logical analysis of the semantic and phonetic features common to words than by free association

norms. The free association task deals only with one of many possible reactions to words and association norms do not deserve the explanatory status accorded them in the verbal learning literature (see also Anisfeld, 1967). The alternative to the associative explanation of false recognition rests on the idea that when a word is registered for memory, the coding is in terms of the features characteristic of it. The occurrence of some of the same features in a later word leads either to the lengthening of the time to decide that it is new or to an altogether erroneous decision, i.e., that the word had already been presented.

The relatively lesser effectiveness of semantic relations in producing false recognition errors in the third-grade Ss than in the sixth-grade Ss suggests that at the younger age the semantic features for interrelating vocabulary items are not yet as prominent as the more superficial phonetic features.

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Footnote

1. We are grateful to George Suci for suggestions concerning the design of the experiment and for permission to use his equipment, and to John Doris, Larry Whiteman, and Ernesto Pollitt for suggestions regarding experimental design and statistical analysis. We are also thankful to Drs. Leonard Buyse and J. Douglas Hart for permission to conduct this study in the North East school in Ithaca, N. Y., and for assistance throughout its duration. The research reported herein was performed pursuant to a contract with the U. S. Department of Health, Education, and Welfare, Office of Education.

Table 1

The P, E, and C Words Used in the Experiment

P Words	Semantic Relations		Rhyming Relations	
	E Words[a]	C Words	E Words	C Words
lamp	light	bank	camp	flag
mountain	hill	street	fountain	hammer
kitten	cat	shell	mitten	thimble
city	town	life	kitty	zebra
house	home	ship	mouse	glove
carpet	rug	soup	market	army
thief	crook	tag	brief	ripe
loud	noisy	crazy	cloud	boot
wish	want	look	fish	coat
gun	rifle	bubble	run	cut
stove	oven	shelf	drove	dig
cold	freezing	cheerful	hold	use
boy	girl	fire	toy	priest
slow	fast	next	blow	hang
up	down	less	cup	chair
hard	soft	cute	card	wind
high	low	first	my	her
white	black	round	right	best
live	die	bring	give	could
cry	laugh	learn	try	tell
find	lose	hurt	mind	king
go	come	keep	row	feed
sweet	sour	plump	feet	bird
take	give	kill	make	help

Note.--The words in each column are grouped in four sets, six words each. The first three words in each set appeared in List A and the last three words in List B.

a. The first six words in this column are High-Association Synonyms, the second Low-Association Synonyms, the third High-Association Antonyms, and the last Low-Association Antonyms.

Table 2

Comparisons Between the Mean Number of Errors to E Words and to C Words for Each of the Five Word-Categories by Grade

	Semantic Relations				
	Hi.-Ass. Synon.	Lo.-Ass. Synon.	Hi.-Ass. Anton.	Lo.-Ass. Anton.	Rhymes
		Grade 3			
E words	.52	.48	.35	.45	2.08
C words	.20	.42	.28	.28	.92
$t(39)$	3.35**	<1	<1	<1	3.71**
		Grade 6			
E words	.50	.55	.50	.75	1.80
C words	.15	.25	.20	.22	.88
$t(39)$	3.02**	2.51*	2.08*	3.41**	2.66**

Note.--The number of words in each of the four Semantic categories was 6 and in the Rhyme category 24.

*$p < .05$, **$p < .01$, two-tailed tests.